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### INTENSITY REQUIREMENTS OF ULTRAVIOLET LAMPS

At the meeting last month of the International Committee on Measurement and Standardization of Ultraviolet Radiation for Use in Medicine, at Wiesbaden, Germany, the Bureau was represented by Dr. W. W. Coblenz, a member of the committee for the United States. Dr. Coblenz, by invitation, presented a paper entitled "Physical Methods of Lightdosimetry," and, because of its direct bearing on this subject, he also recounted some of the activities of the Council on Physical Therapy of the American Medical Association, in cooperation with the Bureau, in promulgating requirements for intensities of ultraviolet lamps acceptable for therapeutic purposes. The principal facts brought out are the following:

The question of standardization had its origin in a specific request from physicians for a simple means of determining whether a lamp emits an appreciable amount of ultraviolet radiation. Hence, after due consideration,

the Council on Physical Therapy of the American Medical Association adopted, and until a more practicable and reliable procedure is proposed, will use, the erythral reaction as a criterion for judging the effectiveness of an ultraviolet lamp, for the following reasons: (a) it is in common use as an indicator of skin tolerance to ultraviolet radiation; (b) the correlation of the physiologic (erythral) reaction to ultraviolet radiation with the radiometric evaluation of the stimulus is established with sufficient accuracy to permit a calculation of the approximate time of exposure, based upon a simple measurement of the ultraviolet radiant flux emitted by the lamp; (c) it is a simple and practicable means of preventing severe burns when using powerful sources of ultraviolet radiation; and (d) it is an efficient safeguard against the fraudulent sale of lamps that emit little or no radiation of wave lengths shorter than about 3,132 Å, generally accepted as having a specific effect in preventing rickets.

The Council does not prescribe the dosage. Its function is to keep the

medical profession and the laity advised on the properties of the numerous devices offered for use in physical therapy.

In writing such a specification 5 years ago the Council was fully aware of the fact that the erythemogenic property of the lamp is not necessarily a measure of its healing power. However, with the widespread advertising of lamps for healing purposes, some so weak in ultraviolet radiation that 20 hours, or longer, would be required to produce a mild (if any) erythema, some action had to be taken. As shown in Dr. Coblenz's paper on dosimetry, the recent investigations confirm the earlier work showing that the spectral limits of antirachitic action are practically coincident with that of erythemogenic action. Hence, the antirachitic dosage (healing power) of the ultraviolet lamps now in use depends upon skin tolerance as determined by the erythema reaction.

In its acceptance of ultraviolet radiators the Council makes a distinction between lamps for use by physicians; and lamps for use in the home, without an experienced technician. For use in the home the Council accepts only lamps that emit little or no ultraviolet radiation of wave lengths shorter than 2,800 Å. This is because of the widespread belief that for general body irradiation it is desirable to confine the spectral range of wave lengths to closely that of sunlight.

The Council's specification of the minimum ultraviolet radiant flux that a lamp must emit in order to qualify as a therapeutic agent is based upon the correlation of the erythemogenic action and the radiometric evaluation (in absolute units) of the intense and easily isolated emission line of the mercury arc of wave length 2,967 Å, which is used as a standard.

The Council has adopted 10 microwatts per square centimeter of homogeneous radiation of wave length 2,967 Å as the unit of erythema flux, and has (tentatively) called it the Finsen Unit (F. U.); that is, 1 F. U. = 10 microwatts per square centimeter (100 ergs per cm<sup>2</sup> per sec.) of wave length 2,967 Å. On the basis of the Council's specification of an exposure of 15 minutes, it will require a flux density of 20 microwatts per cm<sup>2</sup> (2 F. U.) of homogeneous radiation of wave length 2,967 Å to produce a minimum perceptible erythema. The amount of ultraviolet radiation of wave lengths shorter than and including 3,132 Å that a source of heterogeneous radiation must emit, equivalent to 20 microwatts per

cm<sup>2</sup> of homogeneous radiation of wave length 2,967 Å, is obtained by dividing the 20 microwatts by the erythemogenic efficiency of the source in question. For example, the erythemogenic equivalent of sea level, noon hour, June sunlight is  $(20 \div 0.22 =)$  90 microwatts per cm<sup>2</sup> and for the type G mercury vapor glow lamp it is  $(20 \div 0.185 =)$  108 microwatts per cm<sup>2</sup>. Data of this type were presented by Dr. Coblenz at the Copenhagen meeting of the International Congress on Light in 1932.

After the ultraviolet spectral energy distribution of a given type of lamp is known, it is a simple matter to measure by means of a differential thermopile and barium flint glass filter (as recommended by the International Committee at Copenhagen in 1932) the total flux of wave lengths shorter than and including 3,132 Å, emitted by a particular lamp, and thus determine whether it is acceptable.

The Council's requirements for acceptance of ultraviolet lamps have been in use for about 5 years. During this time there have been no difficulties or misunderstandings. Usually the radiometric evaluation of the ultraviolet intensity of a particular kind of lamp, and the calculation of the time required to produce a minimum perceptible erythema (one that disappears in 24 hours), based upon this radiometric evaluation and the erythemogenic correlation, are in close agreement with the data supplied by the manufacturer. In the one or two instances where there was a disagreement in the evaluation of the ultraviolet intensity, the manufacturer accepted the Bureau's findings in preference to his own.

In view of the differences in opinion regarding the use of the erythema reaction in connection with the sale and use of ultraviolet lamps, it is of interest to note that in at least three instances, the above-mentioned lamp manufacturer had obtained his erythema standard by observations on a group of workers in his own factory. Nevertheless, there was good agreement between his claims and the Bureau's tests, which would seem to indicate that, in spite of the great variations noted in erythema sensibility of different persons, there is no great difficulty in obtaining an average value of the erythema response, by a judicious selection of a group of healthy persons of average skin pigmentation, for use in standardizing one lamp.

The acceptance of infrared radiators involves no difficulties since so many

(of 250 to 500 watts) are on the market for heating rooms, etc. The present tendency is toward the use of tungsten filament lamps (250 to 500 watts) because of the large amount of deeply penetrating infrared radiation of wave lengths 8,000 Å to 12,000 Å emitted.

In conclusion, Dr. Coblenz pointed out that the activities of the Council on Physical Therapy of the American Medical Association are in keeping, at least in spirit, if not in all details, with the recommendations of the International Committee on Measurement and Standardization of Ultraviolet Used in Medicine. That the Council is apparently not following more closely the recommendations of the International Committee is to be attributed to the fact that its system of ultraviolet evaluation was promulgated prior to, and is more comprehensive than, the Committee's proposals to the International Congress of 1932.

#### COMPARISON OF DATA ON THE IONOSPHERE, SUNSPOTS, AND TERRESTRIAL MAGNETISM

Observations of the ionosphere made by the Bureau during the past 6 years have resulted in new information on the relations between radio wave phenomena and disturbances in the earth's magnetic field and the variations of sunspots, which is presented in RP913 in the Journal of Research for September.

The three recognized regions of the ionosphere are the E (100 to 120 kilometers high), the  $F_1$  (200 to 230 kilometers) and the  $F_2$  (240 to 500 kilometers). These regions are capable of reflecting radio waves back to the earth, and are responsible for long-distance radio transmission. The upper limit of the frequency which at any given time can be reflected back to earth is known as the critical frequency, and has a definite diurnal variation. The graphs of the E and  $F_1$  critical frequencies are symmetrical about the noon axis. This is not true of the  $F_2$  critical frequency, which, moreover, is much more variable.

Comparison of the seasonal variations of the noon critical frequency and virtual height of the  $F_2$  region indicates that high values of critical frequency are accompanied by low virtual heights and vice versa. Two maxima of critical frequency appear each year, approximately in February and November. Low critical frequencies are predominant in the summer.

The seasonal variation of  $F_2$  virtual height is similar to the seasonal variation of the horizontal component of the earth's magnetic field.

Annual averages of the noon critical frequencies show a good correlation with annual average sunspot numbers.

Critical frequencies of the  $F_1$  region at midnight appear to be decreased by the occurrence of magnetic disturbances, especially in the summer.

#### IONIZATION OF AIR BY LENARD RAYS

Lenard rays in atmospheric air have been measured by means of simple ionization chambers. At ordinary intensities, encountered with Lenard rays, it is impossible to saturate such ionization chambers and this has resulted in neglect of the method for practical purposes. It has been found, however, that plotting the reciprocal current against the reciprocal voltage, a straight line results, which can be extrapolated to  $1/V=0$ ; thereby giving the current at infinite field. A number of such cases are given in RP924 in the September Journal of Research. Unipolar conductivity is evident in at least one ionization chamber.

#### ELECTRIC MOTOR FOR RADIOMETEOROGRAPHS

In connection with its work on radiometeorographs, which are carried aloft by sounding balloons and are used to send out automatic radio signals giving information on weather conditions, the Bureau has constructed a small direct current motor weighing less than 100 grams, operating on 8 milliamperes at 4.5 volts. A model has been built which gives fairly constant speed and appears to offer considerable improvement over spring-driven clocks formerly used.

#### ELECTROLYTIC MEASUREMENT OF THE CORROSIVENESS OF SOILS

Corrosion of metals in soils is accompanied by a flow of current which is discharged into the soil at the anodes or corroding areas and returns to the metal surface at the cathodic areas. Since corrosion proceeds through the action of electrolytic cells, a study of the electrical properties of soil cells in which one electrode is made the corroding element, may contribute to a knowledge of the mechanism of corrosion in soils and to the development of a satisfactory test for soil corrosiveness.

The primary purpose of a study described in the September number of the

Journal of Research (RP918) was to determine whether the relative corrosiveness of soils toward iron and steel could be predicted from measurements of the electrical properties of corrosion cells in which the electrodes were of the same ferrous material and the electrolytes were various soils of known corrosiveness. A satisfactory electrolytic test would render unnecessary the determination of various factors in corrosion such as hydrogen-ion concentration, total acidity, and concentration of soluble salts, the influence of which on the rate of corrosion would be manifested in the electrical properties of the corrosion cells.

From measurements of current and potential in corrosion cells, either with an impressed emf or with only the emf associated with the corrosion of the anode, it was possible to arrange a large number of soils in approximately the same order of corrosiveness as that obtained by loss-of-weight tests conducted for short periods in the laboratory, and by field tests over a period of 12 years.

The essential information to be obtained from laboratory tests of soil corrosiveness is provided by measurements at various current densities of the voltage of the cell, corrected for IR drop. The average current density corresponding to the voltage range from 0 to 0.3 volt is a convenient expression of the information contained in the current density-potential curve.

The chief factors inducing corrosiveness in soils are: (1) high concentrations of soluble salts, especially those of the alkali metals, and (2) high acidity. Both of these factors increase the solubility of the hydroxides of iron and retard the formation of protective layers of corrosion products. Corrosion is relatively slight (1) in soils in which the content of bicarbonate is equivalent to the sum of the calcium and magnesium, and (2) in well-aerated soils, in which the hydroxides of iron are precipitated in immediate contact with the corroding surface.

The results of the laboratory tests indicate the average extent of corrosion which might be expected on a definite area (for example, 1 square foot) of a ferrous material after 12 years' exposure to soil. Since the primary cause of the failure of a pipe line is not the uniform attack of the pipe but the development of pits which penetrate the pipe wall, the results of tests of soils in the laboratory do not in themselves indicate the useful life of pipe in a certain soil, or the number of leaks

which might be expected on a given section of pipe line after a definite period of exposure to the soil. Such calculations require that the laboratory data be related to the average depth of the deepest pits on a given area in a given period, and that the relations connecting depth of pit with the area exposed and the time be approximately known. A study of these relations is now in progress.

#### SALT SPRAY TEST FOR STAINLESS STEELS

The so-called "salt spray" test is widely used for stainless steel. Although the test has been severely criticized as a basis for predicting the behavior of these steels under general service conditions, it may be very useful for showing whether or not the surface has been finished in such a way as to insure maximum corrosion resistance.

Recently several bars of cold rolled chromium-iron alloy (17 percent chromium), with surfaces ground smooth and bright, intended for outdoor exposure at an inland location, were exposed in a mist of a 20 percent sodium chloride solution for 24 hours. As a result, numerous rust spots appeared at isolated points over the surfaces of the bars. However, after refinishing (during which a layer approximately  $\frac{1}{100}$  inch thick was removed from all surfaces) no pitting or rusting whatsoever was observed when the bars were exposed to the same test conditions. The test, in this case, proved that, had the bars been left with the original surface finish, the maximum resistance to corrosion inherent in the material could not have been obtained.

#### INSPECTION AND TENSILE TESTS OF SOME WORN WIRE ROPES

Wire ropes in service are inspected from time to time to determine when their strength has decreased so much that they should be replaced. Although great care is taken when inspecting ropes on elevators and other machines, the failure of which would endanger life or property, inspectors have had to depend largely upon judgment based on experience when deciding whether or not to take a rope out of service.

In cooperation with the special committee on wire rope of the American Society of Mechanical Engineers, the Bureau inspected and tested 229 worn ropes submitted by 79 users. The results are given in RP920 in the Sep-

tember number of the Journal of Research.

The strength was estimated, using charts prepared by the Roebling Co. It was found that the estimated strength and the actual strength were nearly the same. It is believed that by measuring the length of the worn portions of the outside wires and counting the number of broken wires in a rope, its strength can be determined with sufficient accuracy to decide whether or not the rope should be continued in service.

#### CONSTITUENTS OF PORTLAND CEMENT CLINKER

Anomalies in the properties of portland cement indicate that the compound composition of cement clinker may deviate somewhat from that ascribed to it. The structures of both commercial clinker and laboratory preparations have been investigated at the Bureau by means of the petrographic and metallographic microscopes and some preliminary observations will be found in RP917 in the September number of the Journal of Research. The deviation of the composition of one constituent from that of pure  $3\text{CaO} \cdot \text{SiO}_2$  has been shown by microscopic structures and by X-ray patterns. The variations in optical properties of  $2\text{CaO} \cdot \text{SiO}_2$  may be due to the presence of twinning bands and not to the existence of the alpha form at low temperatures. The structural characteristics of two other major constituents of clinker have also been described.

#### COLOR OF ABACÁ FIBER IN RELATION TO DETERIORATION BY WEATHERING

A preliminary investigation to determine the relation between the color of abacá fiber and its resistance to natural weathering was recently completed in the Bureau's textile laboratories, and will be published in a forthcoming number of "Cordage." Fiber grades AB, J1, and II were exposed continuously to the weather at an angle of  $45^\circ$  facing south. The relative effects of exposure on the fibers were evaluated in three different ways: (1) decrease in strength, (2) decrease in strength per unit weight of fiber, and (3) decrease in strength per unit of surface area of fiber. The fibers of grades J1 and H decreased in breaking strength as much or more than the fibers of grade AB in the first 4 days, but less in the longer exposures. The results were practically the same when

calculated on the basis of breaking strength per unit of weight of fiber. When calculated on the basis of the breaking strength per unit of exposed surface area, grade H fiber decreased in strength in all exposures more than the grade AB fiber. The decrease in strength per unit surface area of grade J1 fiber was more than that of grade AB in the longest and shortest exposures, less or equal in the intermediate exposures. The source, Becker value, breaking strength and weight of fibers from each of the 10 standard abacá grades will be included in the report, as well as the area of cross sections of AB and J1 fibers and the breaking strength per square millimeter of cross section area.

#### PROPERTIES AND SERVICEABILITY OF SILK-DRESS FABRICS

A study of the serviceability of 69 silk-dress fabrics was started during the spring of 1930 by the American Home Economics Association with the cooperation of college students and teachers, and the Bureau. The students purchased silk fabrics in the local stores, made dresses for themselves, and observed the performance of the dresses in service, all as a part of their class assignments.

Samples of the fabrics were analyzed and tested at the Bureau, and 23 of the dresses showing the results of wear were examined, along with reports on their behavior in service. In addition, five reports of serviceability, submitted without the corresponding dresses, were examined.

Good correlation was found between the results of laboratory "performance" tests on color fastness, breaking strength, and aging characteristics of the fabrics, and the behavior of the dresses in service. In addition to these properties, resistance to yarn slippage at the seams and in the fabric is important. No relation between the serviceability of the dresses and the construction or price of the fabrics was indicated.

These results point to the practicality of evaluating dress fabrics by performance tests and of setting up standards for serviceability on this basis. Methods for determining these important properties were recently brought together in Commercial Standard CS 59-36, "Woven Dress Fabrics—Testing and Reporting", at present available in mimeographed form, and which will soon be obtainable as a printed publication.



### ELIMINATION OF DIFFERENCE IN SACCCHARIMETER SCALES

Two different saccharimeter scales are in use today and although each purports to give the correct amount of sucrose in a sample, there is an outstanding difference between the two of approximately 0.01 percent. The industrial importance of the commodity sucrose and its associated products in international trade requires that this difference be eliminated.

Research into the history of the French Sugar Scale and its normal weight discloses the fact that the value of this constant now in official use was originally adopted upon evidence which at the present day would be considered insufficient, and that although the two subsequent outstanding experimental redeterminations of this constant gave results somewhat smaller than the official value, those results were considered at the time to be ample confirmation of the then accepted value. A calculation from modern data shows that the French normal weight required to bring the International Sugar Scale and the French Sugar Scale into agreement is exactly that actually obtained by the older French investigators mentioned above.

### PREPARATION AND PROPERTIES OF CALCIUM LACTOBIONATE-CALCIUM BROMIDE

The double salt of calcium lactobionate and calcium bromide which was prepared for the first time at the Bureau gives promise of becoming an important medicinal agent. According to clinical tests published in foreign journals, its sedative action is almost twice that which corresponds to its bromine content, and when administered in effective quantity it does not cause "bromide rashes" such as frequently develop when alkali bromides are used. The prevalence in the United States of neurasthenia and similar ailments which require sedatives of various types should afford a lucrative market for this salt. The simple process for its manufacture reported in the *Journal of Research* for September (RP914) should make it readily available.

### EBULLIOMETRIC AND TONOMETRIC MEASUREMENTS ON NORMAL ALIPHATIC HYDROCARBONS

By the application of the very precise method developed by W. Swietoslowski for measuring the boiling points and the differences between boil-

ing point of liquids and the condensation temperature of their vapors, it is possible to determine several facts of interest to the chemist. Among these are the purity of the substance under investigation, its boiling point, and the relation of boiling point to pressure.

The normal hydrocarbons, pentane, hexane, heptane, and octane, have been studied by this method. The ebulliometric control of purity of the preparations, the use of substances of high purity, and the application of a method of comparative measurements insure the accuracy of the results which are reported in RP921 in the *Journal of Research* for September.

The numerical data are as follows: *n*-pentane, boiling point 36.077,  $\frac{dt}{dh} = 0.0391$ ; *n*-hexane, boiling point

68.733,  $\frac{dt}{dh} = 0.0420$ ; *n*-heptane, boiling point 125.658,  $\frac{dt}{dh} = 0.0477$ .

It was found that the introduction of a  $\text{CH}_2$  group into the chain of each of the investigated normal aliphatic hydrocarbons, has the specific effect of increasing the  $\frac{dt}{dh}$  ratio by the amount 0.0029.

### EMPIRICAL RELATION BETWEEN THE ATOMIC DIMENSIONS AND THE MELTING AND SUBLIMATION POINTS OF THE NOBLE GASES, HALOGENS, AND ELEMENTS OF THE SULPHUR GROUP

In comparing the melting points of the noble gases, halogens, and elements of the sulphur group it has been found that, of these groups, those elements which have analogous differences in atomic structure show an apparent simple relationship between their melting points and their atomic dimensions, the differences in the melting points being proportional to their respective differences in atomic radii.

Further, it was found that for these elements with analogous differences in structure an apparent proportionality exists between the differences of the atomic radii on the one side and the respective differences of sublimation points at low pressure on the other. These relationships are reported more fully in RP915 in the September number of the *Journal of Research*.

### CONTROL OF TEMPERATURE IN PRECISE INDEX OF REFRACTION MEASUREMENTS

For general use in the accurate and precise measurement of index of re-

fraction by the minimum-deviation method it appears desirable to describe the temperature housing for the prism, as used in the Bureau's refractometric laboratory. As set forth in RP919 in the *Journal of Research* for September, provision has been made for mounting the prism on a set of double ways in a temperature-controlled bath of stirred air inside a water-jacketed cylinder. The ways are operated from outside the housing in order to permit re-adjustments of the prism without disturbance of temperature equilibrium. To provide for measurements on prisms having various optical densities and a wide range in their refracting angles, the plane-parallel windows of the cylindrical housing are adjustable through wide limits in azimuth with respect to the prism table and to each other.

The jacketing fluid, conditioned by a thermo-regulator, is circulated by means of a motor-driven rotary pump to the prism housing through hose connections from a mixing chamber which is situated on a shelf directly above but independent of the spectrometer. With the air stirrer driven by a compressed air jet, undesirable weight on the prism table of the spectrometer is avoided by a counterbalance and a three-point suspension of piano wire.

In using this housing to determine refractive indices the additional operations, as compared with usual procedures, are (1) the adjustment of the thermo-regulator and its system, and (2) the proper orientation of the windows of the housing. The time required is essentially that necessary in establishing temperature equilibrium and most manipulations of the prism and its housing are easily made during that interval.

Accurate and precise measurements on certain optical glasses have shown that this housing is satisfactory for use in the temperature range, 0 to 60° C, for which it was designed.

#### NEW AND REVISED PUBLICATIONS ISSUED DURING AUGUST 1936

##### *Journal of Research*<sup>2</sup>

*Journal of Research* of the National Bureau of Standards, vol. 17, no. 2, August 1936 (RP907 to RP912, inclusive). Price 25 cents. Obtainable by subscription.

<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical

##### Research Papers<sup>3</sup>

[Reprints from the May and June 1936 *Journal of Research*]

- RP887. Effects of partial prehydration and different curing temperatures on some of the properties of cement and concrete. F. B. Hornibrook, G. L. Kalousek, and C. H. Jumper. Price 5 cents.
- RP888. A study of the weathering quality of roofing felts made from various fibers. O. G. Strieter. Price 5 cents.
- RP889. Calculation of the concentration and dissociation constant of each acid group in a mixture from the pH titration curve of the mixture. J. O. Burton and S. F. Acree. Price 5 cents.
- RP890. Thermal expansion of copper-beryllium alloys. Peter Hidnert. Price 5 cents.
- RP891. A rapid method for the determination of silica in portland cement. Edwin E. Maczkowske. Price 5 cents.
- RP892. Note on the thermal mutarotation of d-galactose, l-arabinose, and d-talose. Horace S. Isbell and W. W. Pigman. Price 5 cents.
- RP893. Determination of sulphuric anhydride in portland cement by means of the Wagner turbidimeter. Robert B. Tudy. Price 5 cents.
- RP894. An alternating-current magnetic comparator, and the testing of tool-resisting prison bars. Raymond L. Sanford. Price 5 cents.
- RP895. Dissociation constants of malonic acid in its sodium-salt solutions at 25° C. from electrometric titration measurements. J. O. Burton, Walter J. Hamer, and S. F. Acree. Price 5 cents.
- RP896. Tests of eight large H-shaped columns fabricated from carbon-manganese steel. Ambrose H. Stang, Herbert L. Whittemore, and Leroy R. Sweetman. Price 5 cents.
- RP897. Tests of steel chord members for the Bayonne Bridge. Ambrose H. Stang, Herbert L. Whittemore, and Leroy R. Sweetman. Price 5 cents.
- RP898. Third spectrum of xenon. C. J. Humphreys. Price 5 cents.

##### Simplified Practice Recommendations<sup>3</sup>

- R1-36. Vitrified paving brick. (Supercedes R1-35.) Price 5 cents.

*News Bulletin*, 50 cents per year; *Journal of Research*, \$2.50 per year (United States and its possessions, and Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 70 cents and \$3.25, respectively.

Commercial Standards<sup>2</sup>

CS58-36. Woven elastic fabrics for use in overalls (overall elastic webbing). Price 5 cents.

Technical News Bulletin<sup>2</sup>

Technical News Bulletin No. 232, August 1936. Price 5 cents. Obtainable by subscription.

## MIMEOGRAPHED MATERIAL

## Technical Information on Building Materials

The supply of these notes, each of which consists of three or four pages giving the important facts on some one aspect of the properties or use of building materials, is necessarily limited. Their distribution will be confined to Government officials concerned with building projects, and to architects, engineers, and home builders. Requests should make clear the actual need for the information at the time of writing. Letters should be addressed to the Division of Codes and Specifications, National Bureau of Standards, Washington, D. C. The following notes have been issued since the list published in the August 1936 number of the Technical News Bulletin:

- ✓ TIBM-30. Paint pigments—white.
- ✓ TIBM-31. Paint pigments—black, red, and lakes.
- ✓ TIBM-32. Paint pigments—yellow, brown, blue, green, and bronze.

<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, \$2.50 per year (United States

OUTSIDE PUBLICATIONS<sup>2</sup>

Ionosphere studies during partial solar eclipse of February 3, 1935. S. S. Kirby, T. R. Gilliland, and E. B. Judson. *Proc. Inst. Radio Engrs.* (33 W. 39th St., New York, N. Y.), 24, 1027 (July 1936).

A new system of analytical chemistry for the platinum metals. Raleigh Gilchrist and Edward Wichers. *Trans. Ninth International Congress of Pure and Applied Chemistry* (Madrid, Spain), 6, 32 (1934).

Determination of physico-chemical constants. M. Wojciechowski and Edgar R. Smith. *Nature* (St. Martins St., London, W. C. 2, England), 138, 30 (1936).

A centrifugal filtration tube. David F. Houston and Charles Proffer Saylor. *Ind. & Eng. Chem.* (Mills Bldg., Washington, D. C.), Analytical Edition, 8, 302 (July 15, 1936).

Water absorption of building brick. J. W. McBurney. *Preprint 48* (Am. Soc. Test. Materials, 260 S. Broad St., Philadelphia, Pa.) July 1936).

Mishaps with oil-filled transformers. M. G. Lloyd. *Quar. Nat. Fire Protection Assn.* (60 Batterymarch St., Boston, Mass.), 30, 46 (July 1936).

Government experiments. Lyman J. Briggs. *East St. Louis Today* (East St. Louis Chamber of Commerce, East St. Louis, Ill.), 4, 13 (June 1936). (Same article published simultaneously in official monthly publications of chambers of commerce of other cities.)

and its possessions, and Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 70 cents and \$3.25, respectively.

<sup>2</sup> These publications are not obtainable from the Government. Requests should be sent direct to the publishers.



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